

CLAIMS

1. A method for checking the position of a mechanical part (2) along at least one checking direction (X) by means of an apparatus (1) including a device (6) for generating a light beam (7) along a trajectory (Y) transversal to said checking direction (X), a sensor (8) for detecting the interruption of the light beam (7), and devices (3) for causing mutual displacements between the mechanical part (2) and the light beam (7) along said checking direction (X) and along an inspection direction (Z) transversal to the checking direction (X), the method including the following steps:
 - identifying (19) a first linear interval (X1) and a second linear interval (Z1) of the mutual positions between mechanical part (2) and light beam (7) along the checking direction (X) and, respectively, the inspection direction (Z), said first linear interval (X1) and said second linear interval (Z1) defining a checking area (13) of the mechanical part (2),
 - controlling a sequence of checking displacements between mechanical part (2) and light beam (7), including
 - displacements (29) for bringing the light beam (7) to inspection positions (Pi;P1-P4) of the first linear interval (X1), and
 - at said inspection positions (Pi;P1-P4), linear inspection movements (30) along said inspection direction (Z),
 - detecting (31-34) the interruption or the non-interruption of the light beam (7) in the course of said linear inspection movements along the inspection direction (Z), and consequently selecting (35,36,38) the subsequent of said inspection positions (Pi;P1-P4) of the first linear interval (X1) at which the subsequent linear inspection movements are controlled,
 - stopping (37) the sequence of checking displacements at a final inspection position (PN) of the light beam (7)

- in the first linear interval (X1) that lies at a distance (D) less than a preset value (W) from a previous inspection position (Pi;P1-P4), where, in the course of linear inspection movements at said final inspection position (PN) and said previous inspection position (Pi;P1-P4) in the first linear interval (X1), there have been detected, respectively, the interruption (32,34) and the non-interruption (31,33) of the light beam (7), or vice versa, and
- 10 • identifying (41) the position of the mechanical part (2) along the checking direction (X) on the basis of said final inspection position (PN).

2. The method according to claim 1, wherein said inspection positions (Pi;P1-P4) of the first linear interval (X1) are selected at distances (D) progressively decreasing from each other according to a convergent sequence.

20 3. The method according to claim 2, wherein said inspection positions (Pi;P1-P4) of the first linear interval (X1) are selected at distances (D) progressively halved from each other.

25 4. The method according to claim 2 or claim 3, wherein said displacements (29) for bringing the light beam (7) to inspection positions (Pi;P1-P4) of the first linear interval (X1) are controlled in a sense (V) or in the opposite sense along said checking direction (X) as a consequence (35) of the detecting of the interruption (32,34) or the non-interruption (31,33) of the light beam (7) in the course of the linear inspection movements at the two most recent inspection positions (Pi;P1-P4).

35 5. The method according to one of the preceding claims, including a preliminary verification phase of said checking area (13) with displacements between light beam (7) and

mechanical part (2) between predetermined points (14,15,16,17) of the checking area (13).

6. The method according to claim 5, wherein said preliminary verification phase includes at least one of said linear inspection movements along the inspection direction (Z).

7. The method according to one of the preceding claims, wherein said linear inspection movements along said inspection direction (Z) are interrupted as soon as the interruption of the light beam (7) is detected (32).

8. The method according to one of the preceding claims, wherein the trajectory (Y) of said light beam (7) and said checking area (13) are substantially perpendicular.

9. The method according to one of the preceding claims, wherein in the step of stopping (37) the sequence of the checking displacements, said previous inspection position (Pi;P1-P4) is the immediately preceding position with respect to the final inspection position (PN).

10. The method according to one of the preceding claims, wherein said light beam is a laser beam (7).

11. A method for checking the position of a mechanical part (2) along at least one checking direction (X) by means of an apparatus (1) including a device (6) for generating a light beam (7) along a trajectory (Y) transversal to said checking direction (X), a sensor (8) for detecting the interruption of the light beam (7), and devices (3) for causing mutual displacements between the mechanical part (2) and the light beam (7) along said checking direction (X) and along an inspection direction (Z) transversal to said checking direction (X), the method including the following steps:

- identifying (19) a first linear interval (X1) and a second linear interval (Z1) of the mutual positions between mechanical part (2) and light beam (7) along the checking direction (X) and, respectively, the inspection direction (Z), said first linear interval (X1) and said second linear interval (Z1) defining a checking area (13) of the mechanical part (2),
- controlling the following sequence of checking displacements between mechanical part (2) and light beam (7)
 - (a) a linear inspection movement (30) along said inspection direction (Z) within the checking area (13), till there occurs one of the following events
 - (i) interruption (32,34) of the light beam (7), or
 - (ii) covering (31,33) of the entire second linear interval (Z1) with no interruptions of the light beam (7),
 - (b) a displacement (29) along the checking direction (X), in a determined sense (V), up to an inspection position (Pi;P1-P4) of the light beam (7) in said first linear interval (X1),
 - (c) the repetition of the linear inspection movement (30) along the inspection direction (Z) according to step (a),
 - (d) a fresh displacement (29) along the checking direction (X) in the sense (V) of the previous displacement, or in the opposite sense, according to (35) whether the event (i) or (ii) that occurred (31-34) in the most recent linear inspection movement (30) be or not be the same that occurred in the previous linear inspection movement (30), up to a fresh inspection position (Pi;P1-P4) of the light beam (7) in said first linear interval (X1), at a known distance (D) with respect to the immediately previous

- inspection position $(P_i; P1-P4)$,
- (e) the repetition of linear inspection movements and displacements, according to steps (c) and (d) - with progressively decreasing distances (D) between the fresh inspection positions $(P_i; P1-P4)$ and the immediately previous inspection positions $(P_i; P1-P4)$ of the light beam (7) in said first linear interval $(X1)$ - till (35,37) the distance (D) between the fresh inspection position $(P_i; P_N; P1-P4)$ and a previous inspection position $(P_i; P1-P4)$ - at which the linear inspection movement causes the occurring of one of the events (i) and (ii) and, respectively, the opposite event - is less than a prefixed value (W) , and
- identifying (41) the position of the mechanical part (2) along the checking direction (X) on the basis of the fresh inspection position (P_N) of the light beam (7) in said first linear interval $(X1)$ at the end of the sequence of checking displacements.
12. The method according to one of the preceding claims, for checking the position of a working area (11,12) of a tool (2) coupled to the turret (3) of a machine tool (4).
13. A system for checking the position of a working area (11,12) of a tool (2) coupled to the turret (3) of a machine tool (4), wherein said machine tool includes a control unit (10) for controlling the steps of a method according to claim 12.